

REMARKS

Claims 1-15 are presently pending in the application.

At the outset, it is noted that the Examiner has indicated claims 1-12 are pending in the application. This is incorrect. Thus, a Preliminary Amendment filed with the application submitted a substitute specification and claims in which the multiple dependencies in claims 3, 6 and 11 were deleted, and new claims 13-15 were added to replace these multiple dependencies. Accordingly, full examination of claims 1-15 is respectfully requested.

The Examiner has objected to the abstract as containing extraneous language. Accordingly, the abstract has been amended to delete the term "comprising" and make the abstract a complete sentence. Reconsideration and withdrawal of this objection are respectfully requested.

Claims 1, 4, 9 and 12 have been amended to specify that the lower material comprises a wood material having a thickness of 3 to 15 mm. These amendments are supported, for example, at paragraph [0035] of the specification. This thickness and material of the lower material allow not only the prevention of low-temperature burn, but also ensure the strength required for the floor heating floor material from the standpoint of the total thickness of the floor material. In view of these amendments, claims 3, 11 and 13 have been amended to specify 4 mm as the lower limit of the total thickness, since the total thickness could not be 2 if the minimum thickness of the lower material is 3 mm. These amendments are supported, for example in paragraph [0036] of the specification.

In addition, all of the claims have been revised to correct syntax, provide antecedent basis for the terms, delete extraneous material, and fill in missing terms to make the claims more readable and understandable. Also, claims 13-15 have been amended to depend instead from claim 12, and claim 15 has been amended to correspond to claims 2, 8 and 10 to avoid redundant claims. These amendments are formal in nature, and no new matter has been added. Accordingly, entry of the amendments is respectfully requested.

Applicants appreciate the Examiner's indication of allowability of claim 6. However, Applicants still believe that the remaining claims are also patentable for the reasons discussed

below. Therefore, claim 6 has not been rewritten in independent form as suggested by the Examiner.

The Examiner has rejected claims 1-3 and 9-11 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent 4,952,775 of Yokoyama et al. ("Yokoyama") in view of Japanese Published Patent Application JP10-266542 of Takeshi et al. ("Takeshi"). The Examiner contends that Yokoyama teaches an electric floor heating system comprising an electric floor heating panel 20 and a floor material 30-33 placed thereon with the floor material having a thickness of 10.3 mm and being formed by laminating integrally an upper material 30 having a thickness of about 3 mm and a heat diffusing material 22 having a thickness of 1.5 mm. The Examiner acknowledges that Yokoyama does not disclose a lower material as part of the floor material or a power range. However, the Examiner concludes that it would have been obvious to one skilled in the art to add a lower material as an obvious design choice, because Applicant has not disclosed that the lower material provides an advantage, is used for a particular purpose, or solves a stated problem. The Examiner also concludes that a desired power range will be determined by the user having a specific and desired result in mind, so that it would have been obvious to use this power range in Yokoyama's electric floor heating system.

With respect to claims 2 and 10, the Examiner acknowledges that Yokoyama does not teach an aluminum material for the diffusing plate. However, the Examiner contends that Takeshi teaches a floor heater panel with an aluminum diffusing plate 6. The Examiner concludes that it would have been obvious to one skilled in the art to modify Yokoyama's invention to use aluminum for the diffusing plate as taught by Takeshi as an obvious functional equivalent.

The Examiner has also rejected claims 4-5, 7-8 and 12 under 35 U.S.C. § 103(a) as being unpatentable over Yokoyama in view of U.S. Patent 6,776,222 of Seki et al. ("Seki"). The Examiner acknowledges that Yokoyama does not disclose a foldable heating panel and boards connected by belts. However, the Examiner contends that Seki teaches a foldable floor heating panel 10 composed of at least three heating boards 11. The Examiner concludes that it would have been obvious to one skilled in the art to modify Yokoyama's invention to include a foldable floor heating panel as taught by Seki to ease floor heating installation and provide belts through the holes as a design choice, because Applicant has not disclosed that these belts provide an

advantage or solve a stated problem. These rejections are respectfully but strenuously traversed for the reasons set forth in detail below.

The present invention was developed to provide a comfortable heating environment without low temperature burn, even when it is necessary to increase the floor heating temperature for heating a room in the case of a very low-temperature environment. In order to achieve this purpose, the present invention provides an electric floor heating system (claim 1), a panel for an electric floor heating system (claim 4), a low temperature burn preventing floor heating floor material (claim 9), and an electric floor heating device (claim 12). These embodiments of the invention have the common technical feature that they are each designed to keep a room at a comfortable heating environment using only the electric floor heating system comprising a panel for electric floor heating (a heater panel, including, for example, a foldable floor heating panel as in claim 4) and a floor material which is constructed with a specific relationship to avoid low temperature burn, even when a portion of a human body is in contact with the heated floor material for a long period of time.

To prevent low temperature burn of a human body in contact with the surface of the floor material, it has been determined that the contacting surface must be adjusted to a maximum of 42°C, even in the case where a large quantity of heat radiation per unit area from the floor heating system is required to keep a comfortable environment, particularly in very low temperature areas. The present inventors found through many experiments in practice for constructing an electric floor heating system with a floor material and a heater panel that a comfortable heating environment could be maintained without causing low temperature burn by constructing the floor material with a specific relationship between the thickness (d) of the upper material of the floor material, the thickness (t) of the heat diffusing material of the floor material, and the maximum power (p2) of the heater panel. This relationship is set forth as equation I in claim 1, and the same relationships are stated in claims 4, 9 and 12. The coefficients (a) and (b) in equation I are values determined experimentally based upon the maximum power (p2) in Watts per square meter (W/m^2) of the heater panels to be used in the floor system.

In other words, as long as the electric floor heating system is designed to meet the equation of relationship I., for example by selecting the values of coefficients (a) and (b) to correspond to the range of dark portions surrounded by the curves in Fig. 2(a) to (d), the

resulting contact surface temperature can be adjusted to be 42°C or below, so that low temperature burn of the human body is prevented.

Embodiments for implementation of the invention are shown specifically in Examples 1 through 5 of the specification. For example, Table 2 (evaluation of Example 1) shows that when an electric floor heating system is constructed using a heater panel having a maximum power of 180 W/m², the use of a floor material composed of a heat diffusion material of 400 µm thickness and an upper material of 0.5 mm thickness results in a contacting surface temperature of 41.3 °C, which does not cause low temperature burn because it is below the 42°C limit.

Turning to the prior art, Yokoyama also discloses an electric floor heating system. However, the Yokoyama system is totally different from the claimed invention, not only in structure, but also in the technical concept for constructing the electric floor heating system. First, there is no suggestion in Yokoyama of constructing a system to avoid low temperature burn of a human body in contact with the heated floor material for a long period of time. As a result, Yokoyama is completely silent as to any particular relationship of the thicknesses of the components of the floor material in relation to the maximum power of the heater panel.

Second, as acknowledged by the Examiner, Yokoyama does not have a lower material as part of the floor material. Instead, the electric heating element 20 of Yokoyama is merely separated from the top cover 30 by a heat-diffusing sheet 22. Contrary to the Examiner's contention that the lower material provides no advantage, no particular purpose, and solves no stated problem, the lower material ensures the strength required for the floor heating floor material from the standpoint of the total thickness of the floor material.

Third, the heat diffusing material 22 of Yokoyama has a thickness of 1.5 mm, which does not fall within the claimed range (30-1,000 µm) of the presently claimed invention. In sum, Yokoyama merely teaches a conventional electric floor heating system which does not recognize or solve any of the problems of the presently claimed invention.

The Examiner relies upon Takeshi for teaching a diffusing plate 6 made of aluminum. However, Takeshi discloses a heater panel for floor heating comprising, in order, a heat insulating material 1, a planar heating material 2, a metal plate 6 and a floor finishing material 7. This is merely a conventional heater panel arrangement like that of Yokoyama. In addition, like

Yokoyama, Takeshi does not address the problem of low temperature burn or teach or suggest any relationship of thickness of the upper material, thickness of the heat diffusing material and maximum power of the electric heater to obtain the necessary floor surface contact temperature to avoid low temperature burn. Moreover, Takeshi does not provide a lower material in the floor material above the heating panel and does not provide the required thickness ranges of the presently claimed invention. Therefore, Takeshi fails to make up for the deficiencies of Yokoyama, and the combination with Yokoyama therefore still fails to teach or suggest the presently claimed invention. Accordingly, reconsideration and withdrawal of the rejections over Yokoyama in view of Takeshi are respectfully requested.

The Examiner relies on Seki for teaching a foldable floor heating panel comprising at least three plate-like heating members. However, like Yokoyama and Takeshi, Seki also teaches merely a conventional foldable floor heating panel and is totally silent as to any relationship between different floor layer thicknesses and the maximum power of the heating panel. Further, Seki is not directed to an electric heater as in the present invention or in Yokoyama. Instead, the foldable floor heating panels of Seki use heat carrier tubes for a heating medium, such as hot water. Therefore, Seki is not properly combinable with Yokoyama, since they deal with two different types of heating systems. In any event, even if the combination of Seki with Yokoyama were proper, Seki still fails to make up for the deficiencies in the teachings of Yokoyama as discussed above. Therefore, reconsideration and withdrawal of the rejection over Yokoyama in view of Seki are respectfully requested.

In view of the above Amendments, it is submitted that the Abstract and claims are now in proper form, and in view of the above Remarks, it is submitted that the claims patentably

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distinguish over the prior art of record. Accordingly, reconsideration of the objections and rejections and an early Notice of Allowance are respectfully requested.

Respectfully submitted,

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(Date)

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Enclosure – Petition for Extension of Time (one month)